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The American Biology Teacher

Vol. 9 NOVEMBER, 1946 No. 2

Of What Does Good Biology Teaching Consist?*

OTIS W. CALDWELL
General Secretary, American Association for the Advancement of Science

Descriptive, Not Statistical

There have been many excellent studies of science teaching based upon the frequency of occurrence of the factors involved. If a certain topic or a certain way of doing things occurs most frequently, that fact is sometimes interpreted as indicating superiority in use. Statistically proved frequency bears no necessary relation to what is best to do. If 700 of 1000 biology teachers start their instruction by individual student microscopic cell study, or if 700 of 1000 physics teachers begin, as did my own physics teacher, by having each student do three days of caliper measurement of steel objects of various forms and sizes, such high percentage of practice may prove no more than that the majority are wrong. Therefôre, I am not dealing statistically, but descriptively with our present topic. It is my purpose to direct attention to one enduring quality of each one of three great teachers of biology.

* Banquet Address, Annual Convention of The National Association of Biology Teachers, Saint Louis, March 30, 1946.

A Great Teacher of Research

Occasionally, there occurs the combination of a great personality, a great scientist, and a great teacher. The infrequency of such combinations makes them conspicuous. Their value to society gives them enduring places in the history of science teaching. Louis Agassiz was such a man. The Agassiz story is fairly well known, but let me remind you of how Agassiz worked with those of his students who later became famous in American biology. It is sometimes said that no other person has exerted so great an influence in the United States and Canada upon research in biology and related subjects.

Agassiz did not accept all those who presented themselves to him as prospective students. Those who came were quizzed, sometimes for a long time, so that the teacher might judge whether it would be worthwhile for teacher and

student to work together. I have in my possession a photograph of a letter written by Agassiz to a Massachusetts lady who had once been declined as a student, but because of "her much asking" finally was admitted to the Penikese school in the summer of 1873. Agassiz's students were a carefully selected group to which important fact I shall refer later.

Most of those students who became famous scientists knew that they wanted to study science when they first went to Agassiz. David Starr Jordan was already an avid naturalist. Samuel H. Scudder began his first meeting with Agassiz by saying that while he hoped to become well grounded in all departments of zoology, he purposed to devote himself specially to insects. Nathaniel S. Shaler, a gifted Kentucky classical student, who entered Harvard while Agassiz was in Europe, had already decided to become a geologist. Others, already on their way, were Burt G. Wilder, Wm. K. Brooks, Charles S. Minot, Charles O. Whitman, Alpheus S. Packard, E. A. Birge, Joseph B. Holder, Wm. J. Beal, Alpheus Hyatt, J. Walter Fewkes, William James, Lucretia Crocker, and a score or more of other well-known American scientists.

Agassiz wanted his students to become good observers, independent, self-reliant, and thorough, able to recognize problems and to solve them.

Burt G. Wilder says of Agassiz, "he placed before me a dozen young dog-fish sharks, telling me to find out what I could about them. After three days he gave me other specimens, saying, 'When you go back to the little sharks you will know more about them than if you kept on with them now'—meaning, I suppose, that I should then have gained a better perspective."[1]

Samuel H. Scudder, later the eminent entomologist, makes a statement, even more striking. When Agassiz had finished his preliminary talk, he suggested that Scudder begin work at once, and handed him a fish which Agassiz extracted from a large jar of old alcohol and said "By and by I will ask you what you have seen." Returning soon, Agassiz said, "No man is fit to be a naturalist who does not know how to take care of specimens," and told him to keep his fish in a tray and frequently pour a little alcohol over it to keep it moist, and he added always to take care "to replace the stopper tightly." No magnifying glass or other instruments were allowed. After a day of Scudder's vacuous looking at the fish, Agassiz returned to question his student, and though he commended Scudder's attempt to make a drawing, he said, "you have not looked very carefully," and said he would question him again next morning. Thus three whole days were given to occasional questions to Scudder about one fish. On the fourth day another fish was assigned for comparative study. For eight months Scudder was kept on comparative studies of alcoholic fish.[2]

In his autobiography, Shaler tells a similar story. Shaler spoke French and German, and read Greek and Latin readily. Particularly pleased with a student with whom he could converse in his native French, Agassiz then discussed French, German, and classical literature. As a result Shaler thought he was scoring high in beginning his work with Agassiz. But soon Shaler was assigned a small, old table, a rusty pan, and an alcoholic fish, and told, "Find out what you can, and when I think you have done the work I will question you." With occasional brief questioning, Agassiz kept Shaler upon that one fish for seven full

[1] Agassiz at Penikese. *American Naturalist*, 1898, by Burt G. Wilder.

[2] In the laboratory with Agassiz. *Every Saturday Newspaper*, 1874, by S. H. Scudder.

days, allowing him no reading or consultation with others. Agassiz's regular reply when Shaler did not answer questions as wished, was "That is not right," and would then leave Shaler to his further study of the fish.[3]

Other Agassiz students have reported the Agassiz method through similar accounts of personal experiences. The method worked well with Agassiz as the teacher and with a remarkably superior group of students. The first extensive trial of the method without Agassiz as the teacher failed. That came about on Penikese Island where in 1873, the great teacher conducted his Penikese summer school of biology. That summer school was the first organized summer school of biology in America. Its first year has furnished guidance and inspiration for our many valuable summer schools of science. But the attempted second year at Penikese, with plenty of good students and with reasonable funds, failed miserably and evanesced. Agassiz had died, and without his personality, extensive and vital learning, his clearly sensed method of study could not keep the school alive. One of my own first biological excursions was to Penikese Island, on which there remained a few fallen timbers of the old barn which had been the laboratory of the Penikese summer school.

Undoubtedly Agassiz's way of working with students exists today under modifications at Woods Hole and at many other places where special students of science gather for instruction and research. The earlier claim that the Agassiz method was good for general instruction has not been substantiated. Even in general college classes in biology, there are but few students who come with any burning desire to study science. Indeed, their feeble flames for science need much good kindling before any heavy wood may be added, and for some there is no feeble flame, and the fuel is "all wet" and fires with difficulty. And in secondary school biology most of the students would be worse than helpless if taught for long by the Agassiz method. For general instruction the Agassiz method needs careful revision.

A Great Laboratory Teacher

The second great teacher of biology to whom I direct attention is James G. Needham, for 30 years a noted Cornell University biologist, a teacher elsewhere, prior and subsequent to his Cornell years. My own first knowledge of Dr. Needham's teaching came to me not by observing him but by a steady stream of favorable comments from those fortunate in having been his students. I had heard of Needham's large classes, of his use of advanced students in his teaching, and of his own frequent but irregular appearances among his laboratory classes for which his advanced students were immediately responsible. I adopted a procedure to allow me to have an unconducted visit to these classes. Of my full plan and purpose for this visit I never told Dr. Needham until early in 1946. Arriving at Cornell, I went to the laboratories and quietly moved about among the students to see how they were working. The work was mostly on insect structures. The specimens had been collected by the students themselves on recent trips, partly as class trips, and partly by groups of students, or individual student trips. The students talked a good deal about the kinds of places in which the different insects had been found, and of how particular structures seemed to be related to living places and habits. The young instructors quizzed students and were quizzed by students. The room was not quiet, but I noted no extraneous noises. It was

[3] The autobiography of Nathaniel Southgate Shaler. 1907.

the talk and movement of a working and well-guided lot of young humans in which the *sapiens* part of *Homo sapiens* was being strongly encouraged to develop. When Dr. Needham entered the large laboratory, I noted no change in vigor, industry, or purpose of students. Indeed, most of the students seemingly did not recognize his entrance. And as he roamed about the room, questioning and being questioned, the students seemed to accept him as one of their own group of learners. He questioned as a learner, not as a quiz master. It appeared to me to be a learning situation in which old and new facts and interpretations found place in the thinking of all concerned. The teacher was not doing the student's learning but guided that learning and made sure that learning took place.

After agreeing to prepare this paper, I wrote to Dr. Needham, now retired, telling him of my visit of thirty years ago and asking him to write me. Amongst other things in his reply I quote the following:

"My practice in teaching biology was very simple. I always told my pupils: 'It is not what I do, but what you do, that educates you.' I brought the pupils and the organisms together face to face, gave the students as good an introduction to the organism as I could, and then kept out of the road. I told my assistants not to point out everything; to allow the students some delight in discovery. And I never believed in biology with life left out. I used much living material.

"Further than that. I took occasion to remind them sometimes that *Growth* is the most noiseless process in the world."

It is to be hoped that, if Dr. Needham should ever note what I am now saying, he will be stimulated to do a paper of his own on this same topic.

A Great Lecturer

There are thousands of people for whom John M. Coulter was America's great teacher of botany. As with Agassiz and Needham, only one of his many excellent qualities will now be cited. He was the unsurpassed lecturer about plants. As his laboratory assistant for two years I had opportunity to observe his teaching, and in laboratory contacts with his students, abundant comments and some prolonged discussions were heard. Those students included college freshmen placed there by deans as they made their checker-board student programs; juniors who found that they must have another science credit; sophomore pre-medics assigned to the course but who wondered what plant study could do for them; and a precious minority who knew something about plant life and wanted to know more.

Dr. Coulter's younger days included much field work in many types of regions. As botanist on the Hayden expedition to the Yellowstone National Park, he roamed widely and with great energy, and made large collections of plants, many of which were later recorded as new to previous records. As a student under Dr. Asa Gray of Harvard, he profited by that remarkable scientist's orderliness and thoroughness. As a teacher and an editor almost from the days of his youth, he had learned what succeeds and what does not. He became so much interested in effective presentation of lectures that he later assigned laboratory and field work to assistants who were his advanced students and he only occasionally appeared in the laboratories. Indeed, he once said that as he proceeded in a lecture the students became of less and less consequence to him. That statement should not be taken too seriously, because the rather infrequent interferences by questions

from students were welcomed by him, in case the questions were not dumb. But students were never allowed to make speeches in his classes.

Dr. Coulter's lecture notes were models, and were exponents of much time thoughtfully used. A lecture began somewhere, went somewhere and stopped somewhere. His topic was stated, its major and subordinate divisions and the illustrations came along in orderly fashion, each part taking its place so naturally that it all seemed to be accomplished simply and easily. His blackboard writing and drawings seemed just then to have occurred to him as he wrote or drew. But these, too, were indicated in his prepared notes. In lecturing he never ceased to rethink what he was discussing. His kindly personality and sometimes playful language scintillated upon a fundamentally serious background. When describing to beginners how the enclosed flowers of figs are pollinated by insects that never escape from the flowers, a student asked, "What becomes of the insects when the figs ripen." The reply was, "We eat them, and have a balanced diet."

Dr. Coulter's lectures were of similar type for elementary and for advanced instruction, having the same quality of preparation, orderliness and completeness. Recent publications caused many side notes in his outlines. What is not known was clearly set off from what is known. He constantly alluded to the outdoor life of plants and counted upon considerable student first-hand experience. On one occasion he remarked, "When I was younger I seriously thought of restricting my students to those reared on farms and in villages, since they have something on which to build." That restriction, never adopted, would be even less possible in times of great decline in rural population. Rather, a substitute for rural life is needed for the increasing number of biology students, and we need to recognize a large amount of city biology which is often ignored.

In stressing the value of Dr. Coulter's lectures, more needs to be said. Lecturing to students is useful when done by those who really can do it effectively. Poor lectures have deadened many science classes. Lecturing thus became a bad habit for many science teachers. The habit became so bad that correctives had to be developed. Conferences between teacher and students proved superior in many cases. Certainly conferences are good for small groups of advanced students. Perfunctory lectures provide the easiest way of disposing of classes. They are also least useful. Some lectures are effective in completely disposing of the students. My own thought is that good lecturing will again come into favor as a part of most effective science teaching. But good lecturing needs the sort of preparation given to it by Dr. Coulter. His was so artful that a faculty dean once told his students to take a course with Dr. Coulter, regardless of which course they should take. In other words, "take Dr. Coulter." Those are very rare science teachers of whom that statement can be made.

Recently 26 Amherst College graduates, now in various kinds of public life, prepared and published an extensive report on what they think Amherst College needs. It is an unusually thoughtful and constructive document. Part of what these business men say about lectures as a means of teaching is quoted:

"The lecture system, skillfully used by gifted teachers, is a valuable method of teaching, especially for younger students and in introductory courses. Attempts to eliminate lectures entirely merely result in their coming back under another name. The lecture system, should, however, always be accompanied by some pedagogic device for putting the student to work upon the

material with which the lecture is concerned and for bringing student and teacher together for regular, frequent, intimate discussion. When this is not done, the result is usually in the end to nullify the educational value of the lecture and to stultify both lecturer and students. The effectiveness of the method which combines the lecture with individual instruction has, on the other hand, been established beyond question in the teaching of the sciences. In these subjects, the student is expected to go from the lecture room to the laboratory, ample facilities at considerable cost are provided to make this possible, and no other method of teaching is deemed admissable."

Through some peculiar thinking or because of absence of thinking a lecture is regarded as coinciding in length with one class period. Who discovered that a lecture is legitimately just one hour in length? A ten-minute or half-hour lecture is often quite adequate and such lectures are most useful in the laboratory when needed. But this would mean coordinated lecture and laboratory work by the same persons. Such a plan does not fit our current and false idea that lectures are done by the main teacher; laboratory work is managed by subordinate teachers. Secondary school biology suffers less than college biology because of this situation. If teaching is worthwhile, it is worth doing in the best possible ways. And if the lecture method is to be used at all, it needs close coordination with other work in the subject. Remember that it is the students who are to do the learning, though teachers also learn, and coordinated learning is essential.

Added Components

I have described one outstanding feature of each of three great teachers of biology. Each of those teaching scientists possessed other desirable qualities. No attempt has been made to list or describe all qualities of good biology teaching. On that we could not fully agree, which isn't important. If the most effective teacher amongst us were to detail his procedures, it is unlikely that other good teachers would fully approve. Those known to be good teachers are usually the ones who are keenest to discover better ways of working with students. Unfortunately many scientists of long experience regard themselves as good teachers when others do not so regard them. The complacency of poor teachers is often costly to their students. Even discussions of teaching are observed askance by many scientists who are proud of being scientists, and who are trusted with problems of instruction. I doubt if scientists generally sense the imperative need of improvement of science instruction. We believe in science and its possible uses in our educational procedures. All the people may now be educated if they will. Most of them will not become scientists, though we'd like them all to become scientific. We are very far from using the sciences with the purpose of having the people become scientific. So far most that we do is designed to encourage the development of scientists, a worthy and necessary, but certainly a partial service.

No set pattern is suitable for all. The good qualities outlined above may stimulate more careful thinking by those who teach. That is the best for which we hope.

TED DOWNS, the author of *Tinian Field Trips* in the October issue, is continuing his graduate study at the University of California. His address is Richmond Terrace, Bldg. W, Apt. 2, Richmond, California.

INSECT GALLS can be collected in the fall of the year. If the insects are still present, place the galls in jars covered with glass plates or fine cloth. Cheesecloth is unsuitable because many species of the gall insects are small enough to escape through the mesh.

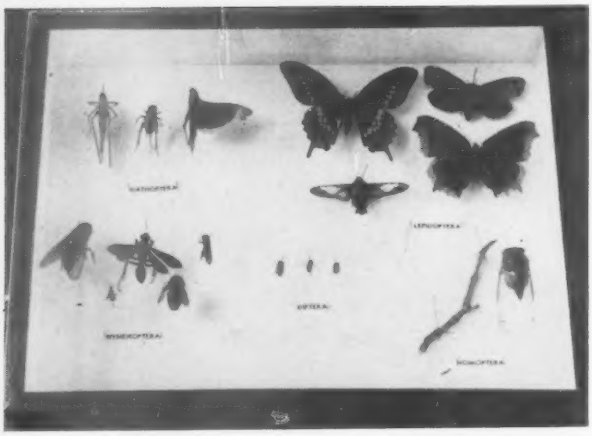
Displays and Exhibits

DONALD S. LACROIX
Amherst High School, Amherst, Massachusetts

Many high school biology laboratories are "spic and span," having nice clean work benches, a series of very neat display cabinets under lock and key and a conservatory in an adjoining room filled with plants and aquaria.

A more "biological" atmosphere can be built up by having the aquaria and plants in the laboratory itself where they can be seen and observed daily. Also added interest is secured if displays, pictures, skeletons, specimens, exhibits, and paintings are arranged in the laboratory. Still more interest and more actual learning can be accomplished if the pupils themselves take part in the preparation and placing of these various attractions. This all gives the impression of having a "work shop" instead of a recitation room.

A display of preserved specimens is a worth-while addition to any biology laboratory, and can be purchased from any science supply house. Fun, valuable experience, and much actual learning can be afforded if the biology pupils themselves make up a display series covering a cross-section of the animal kingdom, and many of the specimens can be procured by the youngsters in one way or another. Glass jars are to be found in any home. They should be of fairly uniform size and shape. Small forms such as insects, spiders, small am-



phibians, etc., can be tied on a piece of glass to keep them up off the bottom of the jar.

For preserving fluid, a 7% formalin and water mixture is good. Insects can be kept in iso-propyl alcohol or even in rubbing alcohol, although the latter is not as good as iso-propyl. A mixture 85 parts of 70% alcohol, 10 parts formalin and 5 parts glacial acetic acid makes an ideal preservative. Most water-inhabiting forms can be anesthetized by adding small amounts of alcohol to the water in which they are collected. Larger forms can be killed the same way but must be opened afterwards to let the preservative penetrate body cavities. Insects can be dropped directly into alcohol.

What can the boys and girls use? What kinds of animals? Leave that to them—or suggest looking for some of the following:

On land:

All local types of animals, earth-worms, hundreds of insect types, land snails, spiders, birds (if you are adept at taxidermy, but don't let the youngsters go out just to kill birds—it's more fun to have a feeding station or to go on bird walks), toads, lizards, snakes, embryos from slaughtered animals.

At the seashore:

Star fish	Sea urchin
Sponge	Sea cucumber
Jelly fish	Sand dollar
Polyps	Barnacle
Coral	Crab
Sandworm	Horse-shoe crab
Lobster	Insects
Fishes	Clam
Octopus	Oyster
Squid	Mussel

Fresh water (ponds, streams, springs, swamps):

Sponge	Snail
Liver fluke	Mussel
Planaria	Fish
Crayfish	Mud puppy
Clam	Frog
Turtle	Salamander
Alligator	Aquatic insects

The Riker mount, a flat cardboard box filled with cotton and having a glass cover makes an excellent display case. Insect life histories, leaf specimens, and many other exhibits may be arranged in these neat, protecting cases. It is well to have a supply of them on hand as the boys and girls will be able to suggest and produce a multitude of interesting displays.

In the same way, exhibition boxes made of cardboard with glass tops can be utilized by pupils. Figure 1 shows a series of representatives of various orders of insects prepared by the boy and girl in the picture at the beginning of the article. The boxes are not expensive to purchase from a biological supply house and the labels can be cut out of old catalogues or can be hand printed.

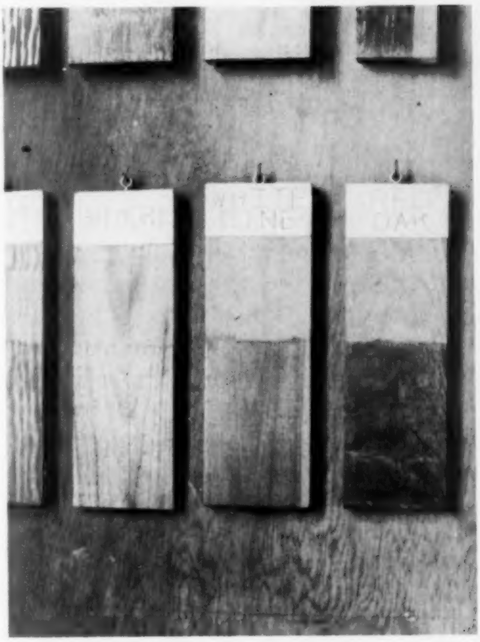
One pupil made little transparent pockets from cellophane saved from cigarette packages and filled them with various types of seeds to show adaptations for dispersal. These envelopes were fastened to a large sheet of cardboard and appropriately labelled.

Ears of corn showing various types or

exhibiting hereditary traits can be hung in the biology laboratory to add interest.

The local druggist often has beautiful posters or reproductions of paintings which he will lend or give away. One drug company is using paintings to portray events in the history of medicine and these make worth while additions to any laboratory.

Some boys who were taking a woodworking course in shop asked their instructor for odds and ends of various kinds of wood. The boys then sawed the pieces to a uniform size, planed them and varnished one-half of each specimen. A screw-eye fastened in one end made it possible to hang these pieces on hooks screwed into a ply-wood board. The photograph (Figure 2) shows one corner of this display board with several wood samples in place.



Teaching and Learning Aids in Biology*

J. W. GALBREATH
Head of Science Department, Senior High School, East St. Louis, Illinois

Teaching and learning aids in biology are so varied and numerous, that in a short report of this type, it is difficult to determine the limits of the field and to do justice to any one aid. I shall limit my discussion to generalization rather than to any one specific aid.

A biology teacher greeting his class for the first time asked: "What will you learn of me?" The reply came: "How shall we learn to live together in peace? How shall we learn to work together? How shall we care for our bodies? How shall we play? How shall we see and understand the things about us? How shall we rear our children? For what ends shall we live?" The teacher pondered these words and sorrow was in his heart, for his own learning touched not upon these things.

* Part of program of NSTA, assigned to NABT.

Although the author who first presented this illustration is unknown, the lesson it imparts needs to be made a part of every biology teacher today. We need to ask ourselves these questions over and over again, until their answers become our way of living and teaching. Real teaching must be human, down to earth, and practical. Modern biology draws from so many fields of knowledge for its materials to fit the interests, needs, and abilities of individual pupils, that no single textbook is adequate. Most of our materials for living and teaching biology lie outside the textbook.

Teaching and learning aids provide the means by which biology becomes the dynamic and fascinating subject of life. Contact with life provides first-hand observation, pulsating with activity rather than the deadening stagnation which re-

sults in contact with textbook alone. It is impossible to do the most effective teaching without a liberal use of the unlimited teaching and learning aids in biology.

It is agreed that one of the chief aims of biology teaching is to acquaint pupils with the nature of the world in which they live. How better can this understanding come about than through the use of such visual aids as specimens, displays, museums, exhibits, charts, models, diagrams, slides, pictures or through the use of educational films?

How better to provide for the varied abilities, backgrounds, interests and needs of our pupils than through the use of projects in our biology courses? The pupil comes in contact with life that is real and purposeful. New knowledge is gained through investigating the wide field of supplementary reading which is needed to answer his own problems.

Supplementary reading is a "must" as a learning aid in biology. It provides a world of pleasure for leisure time, opens up new fields of interest, and provides background for vocation or avocation for later life.

The field trip as a teaching and learning aid in biology provides one of the best methods of gaining first hand experience with living things. Field trips, which are well planned, and purposeful, connect the classroom to the great out-of-doors. They give the boys and girls in our classes the best opportunity to observe the inter-relationship among living things in their natural habitat. They provide excellent opportunities for developing the intelligent conservation minded citizenship so greatly needed today. The participant can actually observe the best methods of soil conservation in the field: an excellent method of teaching wise use of our greatly depleted natural resources.

The great teachers of science are not great because of what they know alone, but because of what they do to their students in arousing and holding their interest and in producing results of the highest quality. Teaching and learning aids are the most effective means in developing this inspiration and motivation in producing this top quality of results in both teacher and students.

Teaching and learning aids in biology are essential in developing the greatest of all rewards to the teacher, the conviction that intellectual curiosity has been aroused in the student.

In this short report only some of the high points have been covered as to the possibilities of a few of the many valuable teaching and learning aids in biology. The possibilities are unlimited to the teacher who would but make an honest investigation about him. No school is too large or too small, no community too barren to provide ample materials for investigation. A specimen may be meaningless to the uninformed but in the hand of the wise and skillful teacher it may become an invaluable aid to learning.

Partial List of Teaching and Learning Aids in Biology From THE AMERICAN BIOLOGY TEACHER

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BEEBE, ELENOR JUNE. *The Problem Child and the Biology Project.* Jan. 1939.

BREUKELMAN, JOHN. *The Aquarium As a Teaching Device.* Jan. 1941, Feb. 1941.

EYESTONE, B. J. *Pupil Activities in Teaching Conservation.* Jan. 1943.

GOUGET, CHARLES W. *The Use of Miniature Dioramas As a Visual Aid in Biology.* May 1942.

GOUGET, CHARLES W. *Your Classroom Can Be a Museum.* Feb. 1943.

GOUGET, CHARLES W. *An Objective Approach to Biology.* Jan. 1939.

GRENLOCK, VICTOR A. *Student Choices of Outside Readings in Biology.* Nov. 1945.

HESS, E. D. *The Use of Objects, Specimens, and Models in the Teaching of Science.* Nov. 1938.
HOFFMAN, CLAUDE I. & PETERSON, DORA. *Teaching Biology by the Project Method.* Nov. 1940.
KEENE, IRVING C. *A Living Biology Laboratory.* May 1945.
LUCAS, LT. (J.G.) G. B. *Factors Which Determine Successful Field Trips.* Feb. 1946.
MICHAUD, HOWARD H. *Importance of Field Work for the High School Biology Teacher.* Mar. 1941.
ORSBORN, H. D. *Supplementary Reading in Biology.* Nov. 1938.
PROCTOR, F. J. *Objective Animal Experiments.* Oct. 1940.
RIESS, KARLEM. *Chemical Gardening in the High School Laboratory.* Feb. 1945.
ROGICK, MARY D. *Field Trips With a Long Range Purpose.* Jan. 1945.
SALISBURY, DOUGLAS. *Winter Field Trips.* Jan. 1941.
SANDERS, KARLYN BEYETTE. *Developing Individual Pupil Interests in Biology.* Jan. 1939.
SEARS, PAUL B. *Teaching Ecological Relationships Through Biological Field Trips.* Feb. 1946.
STEVENSON, ELMO. *Field Trips With Fun.* Jan. 1943.
Special *Field Trip* Issue, Oct. 1941. Articles by Hunter, Mann, Bruce, Salisbury, Yathers, Neher, McCofferty, Thurston, Biebel, Howes.
Special *Visual Aids* Issue, Nov. 1941. Articles by Rogick, Lee, McCauly, Snow, Blandon.

BIOLOGY AT CHRISTMAS-TIME

Every Friday of the last week before Christmas vacation we have a little program on the flora and fauna connected with Christmas. One student is picked by his fellow students to act as Chairman for the day. Reports are given and materials are brought to illustrate the connection between biology and Christmas. The students discuss the Christmas tree. When this is done identification is brought out as well as the eternal problem of the wise use of trees. Pieces of mistletoe are brought in and the lengend explained. The poinsettia name is tracked down and a review of essential flower parts is reviewed. The story behind "attar of roses" fits in at this time. There is an interesting story of the deer of the world in the *National Geographic* educational series.

The students find the use of flavorings, such as spearmint, wintergreen. sage, etc., interesting in connection with foods, traditions and legends of the Yule log, the palm, incense and myrrh helps to round out the background of Christmas as well as the origin of the Chritmas tree. Many additional items can be taken up, such as wreaths and the problems of the cedar, balsam and spruce. The nuts used in the Yuletide season add a little more. The *Nature, Natural History,* and *National Geographic* magazines as well as Christmas books make a good bibliography.

We conclude the period with some material on holly and then sing "Deck the Halls" and other songs.

CHARLES W. SCRIBNER,
Appleton High School,
Appleton, Wisconsin

NEW SLIDE SERVICE

CORONET, is making available 2″ × 2″ Kodachrome slides of the color illustrations featured in the magazine. This new service began with the August, 1946, issue as an experiment. The response from projector owners has fully justified its continuation. Slides are furnished in the usual cardboard mounts at 50c each postpaid.

The principal color feature in the August issue was a series of nine paintings of an imaginary rocket trip to Mars. The September issue contains two unusual color features: HOW YOUR MONEY IS MADE and MEDICINE 100 YEARS AGO. Kodachrome slides of these color features and all others in issues of CORONET from August, 1946, will be continuously available. It will not be possible to furnish Kodachrome slides of color features in earlier issues.

When ordering slides it is only necessary to indicate the page number of the color feature and the issue of the magazine in which it appears. The slides, when shipped, will be similarly identified, so the magazine itself may be used to supply any information required for their use. All orders or inquiries should be mailed to the Education Department, CORONET MAGAZINE, 919 North Michigan Avenue, Chicago 11, Illinois.

From the President

Boston Bound

On December 26 or 27, depending on distance to be traveled, members of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS will pull their feet from under the festive board and wend their ways toward a city rich in traditions of AAAS meetings and cold weather—Boston. Or so we have heard.

Events have occurred this year in the life of the Association which probably will never happen again. First, two annual meetings within the brief space of nine months, were occasioned by the war and its rather abrupt close. Second, it was decided that present officers hold over for an extra six months because of a change in the fiscal year. Both of these events have been privileges and have brought inspiration, but oh! The time and energy and worry and hustle. But if we can be rewarded with news half so pleasing to our ears, and by attendance equal in unanimity and cooperation, it will be more than worth the effort.

Expressions of confidence in THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS and the pleasure of being accepted at face value by some outstanding leaders in THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE surely gave us a "lift" at St. Louis. We now have representation on the *Cooperative Committee*, educational machine of AAAS, and full affiliation with that organization. We can feel very proud to rejoice with AAAS in its acquisition of a new headquarters location. NABT has already made a substantial contribution, and should have more ready.

Dr. Palmer has already lined up a four-star program, using the theme "ecology." Look for complete details in the December number of *The American Biology Teacher*.

We are looking forward to meeting new friends and visiting old ones. With the cooperation of the *American Nature Study Society*, whose help we believe can lead to important ends, this will be a splendid meeting.

If you and your biology teachers haven't done so already, begin now to plan a trip to Boston as a part of your holiday vacation. The Association needs you with your ideas, and—may we say?—you need the Association.

PREVO L. WHITAKER

BOSTON MEETING

At the time of going to press the program was tentatively arranged as follows:

DECEMBER 27, 1946

Bradford Hotel

Business sessions of *Representative Assembly, Executive Board, Editorial Board, Membership* and other committees. Times to be announced.

DECEMBER 28, 1946

Bradford Hotel

Symposium on Ecology and the Teaching of Ecology

Theme: What is Ecology and how may it best be taught?

Morning Program: (Lobby Ball Room)

What in Ecology is Most Significant to the Biology Teacher?

9:00 A. M. *The Ecologists' Viewpoint*, J. M. AIKMAN, President, Ecological Society

9:30—*The Botanists' Viewpoint*, NEIL STEVENS, President, Botanical Society

10:00—*The Limnologists Viewpoint*, J. G. NEEDHAM, Cornell University

10:30—*The Malacologists' Viewpoint*, HENRY VANDER SCHALIE, University of Michigan

11:00—*The Zoologists' Viewpoint*, LOWELL E. NOLAND, University of Wisconsin

11:30 — *The Paleontologists' Viewpoint*, HERVEY W. SHIMER, Massachusetts Institute of Technology

Afternoon Program: (Parlor B)

The Teaching of Ecology

2:00 P. M.—*From the Nature Study Viewpoint*, RICHARD WEAVER, Audubon Nature Center

2:30—*From the General Science Viewpoint,* CHARLOTTE GRANT, Sarah Lawrence College, New York, representing National Science Teachers Association

3:00—*From the General Education Viewpoint,* FRANCIS CURTIS, University of Michigan, representing Department Q, AAAS

3:30—*From the Biology Teachers' Viewpoint,* HOWARD MICHAUD, President-elect of The National Association of Biology Teachers

All of the above meetings are open to members of other organizations interested in the field. We welcome particularly the following:

THE AMERICAN NATURE STUDY SOCIETY, which has expressed special interest in the afternoon program.

THE NATIONAL SCIENCE TEACHERS ASSOCIATION, which has expressed interest in the papers of the morning,

DEPARTMENT Q OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, with which our organization is affiliated.

Banquet, 6:30 p.m.

PAUL B. SEARS, Oberlin College

Human Ecology

Reservations for the banquet may be made at our headquarters, Bradford Hotel. Guests and friends are cordially invited.

Additional details of the program will appear in the December number.

Note to speakers: You are requested to submit an abstract of your paper to E. L. PALMER, *Fernow Hall, Ithaca, New York,* OR to THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, *Washington, D. C.,* by December 1. You are requested to be sure that your personal address accompanies your abstract.

THE AMERICAN NATURE STUDY SOCIETY

December 27–28, 1946

Bradford Hotel—Parlor A

Friday, Dec. 27, 9:00 a.m.: Chairman, CHARLES E. MOHR, President

How to increase natural resource planning and conservation education in our school programs through present subject matter areas.

Friday, Dec. 27, 1:30 p.m.: Chairman, RICHARD L. WEAVER, Secretary

The Workshop method in training teachers and leaders in conservation and planning programs in conservation.

Friday, Dec. 27, 6:30 p.m.: Chairman, CHARLES E. MOHR

The American Nature Study Society's **Dinner and Annual Meeting.**

Friday, Dec. 27, 6:30 p.m.: Oval Room, Bradford Hotel: Chairman, CHARLES E. MOHR

The American Nature Study Society's Dinner and Annual Meeting.

ELLEN EDDY SHAW, Honorary Member—"Nature Study Looks Ahead."

KATHERINE PALMER, "Fun with Fossils."

EDWIN WAY TEALE, Author and Naturalist—"Henry David Thoreau as a Naturalist." (Illustrated in color.)

Saturday, Dec. 28, 9:00 a.m.: Chairman, CHARLES E. MOHR

Saturday, Dec. 28, 1:30 p.m.: Chairman, BILL VINAL

Improving Camping Education through greater use of natural resources.

CENTRAL ASSOCIATION OF SCIENCE AND MATHEMATICS TEACHERS

The committee in charge of the 1946 convention is directing its efforts towards building a convention program around the slogan —"New Power, Products, and Personnel." Through talented speakers, exhibits, and demonstrations such concepts as are outlined in the following paragraphs will be translated into practical procedures for teaching science and mathematics.

NEW POWER

Concepts of Air Age and Atomic Age education bring us to new frontiers in modern living. Some of these frontiers will be developed immediately; others, ultimately.

PRODUCTS

New products, new materials, and new services are in the offing for American people. They may result in new jobs, new factories, new labor problems and the need for a much greater application of SCIENCE AND MATHEMATICS to the development of such social and political measures as will lead to a society geared to the promotion of better living for all people.

PERSONNEL

World War II has focused attention on the importance of science and mathematics in the training of military personnel. Now that the war is over, we must face the fact that well trained scientists and mathematicians will be needed to help preserve national safety and to permit this nation to cooperate effectively in the maintenance of world peace.

Furthermore, health and safety will depend, in part, upon medical science reducing the number of deaths from contagious and

degenerative diseases. Hence, we must not overlook the training of a sufficient number of people to do basic research. Then, too, as scientific and mathematical principles continue to be applied to industrial expansion, the need for adequately trained personnel becomes apparent.

Hence, we must be ready to give a certain body of our students such high school and college training as will enable them to fit into fields of research and into technical positions in industries; we must be prepared also to train a certain other body of students for less technical and less skilled positions; and we must be ready to train all people, skilled and unskilled, to live and work effectively in the world as we will experience it TODAY and TOMORROW.

The committee in charge of the 1946 convention cordially invites all teachers of science and mathematics to attend. The standard rates for the Book Cadillac Hotel in November will prevail. Why not secure your ROOM RESERVATION NOW by writing directly to Mr. C. B. LOFTIS, Front Office Manager, Book-Cadillac Hotel, Detroit 31, Michigan?

The *Biology Section* meeting, Friday, November 29, 1946, is as follows:

Chairman: FRED J. BURDINE, Thornton Township High School, Harvey, Illinois

Vice-chairman: O. D. ROBERTS, Oak Park-River Forest Township High School, Oak Park, Illinois

Secretary: HELEN TROWBRIDGE, Glenbard High School, Glen Ellyn, Illinois

A Chemist Looks at the Manufacture and Control of Pharmaceuticals, Dr. J. RUSSELL BRIGHT, Associate Director of Control of Gelatin Products Corporation. He will have a sound film in color entitled "A Story of Product Development"; his entire talk will consume approximately 50 minutes, including a question period.

Demonstration-Lecture, ELLA M. CLARK, formerly of the Detroit Northwestern High School, Biology Department.

She will present films on the embryology of the bird, a portion of her film on pollination, and part of a reel on the geysers of Yellowstone National Park; this will consume approximately 35 minutes, including a question period.

Illustrated Lecture on Conservation Education Camp for Teachers—to be held this summer in Versailles State Park, Dr. HOWARD H. MICHAUD, Associate Professor of Conservation, Purdue University.

He will present an illustrated lecture with kodachrome slides to last approximately 30 minutes.

The *Conservation* group meeting, Saturday, November 30, 1946, is as follows:

Presiding: HOWARD H. MICHAUD, Assistant Professor of Conservation, Purdue University, Lafayette, Indiana.

A Discussion of Forestry from the Human Welfare Standpoint, Dr. SAMUEL T. DANA, Dean of the School of Forestry and Conservation, Ann Arbor, Michigan.

Discussion of Indiana's Conservation Education Program (brief), Dr. HOWARD H. MICHAUD, (Presiding officer of the group).

This discussion will be similar to those given by Mr. Capps and Mr. Fisk in previous years.

Uncertain—in communication with Mr. HOFFMASTER, Director of Conservation in Michigan.

Dr. Grant will arrange the program.

HERPETOLOGICA

HERPETOLOGICA is the only publication devoted exclusively to the study of reptiles and amphibians. It is the organ of the Herpetologists League, an AAAS associate. It is published on a non-profit, no salary basis. Manuscripts are welcome. Persons contributing significantly to the study of herpetology become *Fellows* of the League. Chapters or Reptile Clubs formed at Colleges or High Schools may have their own Departments in the publication. It is possible to join the League without subscribing to Herpetologica, but a subscription includes membership. Please contact the Editor-Publisher, Mr. Chapman Grant, 2970 Sixth Ave., San Diego 3, California.

CANCER CONTROL

The Joint Committee on Health Problems in Education, of the NATIONAL EDUCATION ASSOCIATION and AMERICAN MEDICAL ASSOCIATION, meeting at Chicago, May 14, 15, and 16, 1946, adopted the following statement:

Cancer control is a major health problem in the United States. As such, it merits attention not only in programs of research, but also in programs of education. Instruction concerning the nature of cancer and known methods of prevention and control should be included in the high school course of study, along with other important health problems facing the American people today. High school students are interested in such information. Scientific facts should be taught to them so that fears may be allayed, intelligent action as future adults be promoted, and families favorably influenced by the information which students relay to adult relatives.

What Biological Facts Interest High School Sophomores?

CHARLES E. PACKARD
Alfred University, Alfred, New York

Forty-four girls and twenty-five boys from two biology classes, nearly all sophomores, submitted answers to the following question asked near the close of the work for the first half year: *What topic, subject, or fact has interested you most up to this time in your biology course?* Because of the possible bearing on choice of topic it is noted that the high school is located in a New England town of about 11,000 population, on the Connecticut River about two hundred miles from the seacoast. The surrounding area is one of small farms with some large orchards. Dairying is carried on extensively, as is poultry raising. There are several prosperous industrial plants in the community. Over five hundred pupils attend the high school, one of two serving the immediate vicinity. About a hundred pupils come from outlying districts.

The contributions received, from almost the entire class, were so varied as to be most difficult to classify. Some replied by one or two words, others wrote short paragraphs. A few added reasons for the selection or commented briefly. Five were unsigned but were capable of allocation by sex because of handwriting or other means of recognition. Signing was not compulsory. A few did not hand in a choice and a few were absent. The pupils were asked to leave their contribution in the basket provided for receiving papers; no attempt was made to check upon them to see who did or who did not do so.

It was carefully explained that an honest opinion was desired, that it was not an exercise which would be graded for averaging with other marks. Time was allowed for considering the matter briefly and sample topics were merely mentioned as illustrative of what was wanted. The instructor was curious to see what particular points, if any, had made general appeal; to see if there was correlation between class discussional emphasis and impression; to find out whether some common prejudices had been overcome; to link topics chosen with individual pupils provided names were signed, and it was expected that nearly all would be; to discover what might be results that could be useful in guiding future treatment of the subject matter. It was expected that a similar procedure would be followed at the close of the year. This was not possible because of the resignation of the instructor to carry on the training of cadet nurses elsewhere.

For the first half year in question thirty-one chapters (499 text pages) were covered in reading assignments, scientific term studies, question problems, laboratory exercises and class discussions. There were some project assignments, and outside readings in supplementary booklets, other texts, magazines, etc. Illustrative material was introduced into class periods and "free reading" in class on special topics was a practice employed from time to time. The broad unit subjects were four:

The Fundamental Likenesses of All Living Things
How Plants Solve the Problems of Life
How Invertebrates Solve the Problems of Life

Vertebrates Have Life Problems Similar to Those of Lower Animals

In the last unit birds and mammals had not been treated. Since the dinosaurs offered an excellent opportunity for introducing the study of fossils this topic was taken up in connection with the reptilia. Problems involving man, evolution, heredity, conservation, the history of biology and the future of the field were yet to be considered.

Rough groupings and tabulations can be made although the diversification of answers complicates classification of the facts obtained. Some statements were double in nature, part very comprehensive, others much less so. The results are shown in the accompanying table.

Generality of answer	Boys	Girls
Facts Broadly Inclusive	15	31
Factually Limited	10	15
By kingdom		
Animals	17	28
Plants	3	9
Either	5	5
Neither (Chemistry)	—	2
By biological subdivision		
Definitely Morphological	3	5
" Physiological	3	13
" Embryological or Developmental	4	2
" Paleontological (Fossils)	2	6
" Evolutionary	1	4
" Ecological	1	1
By Taxonomic Groups	8	13
Chronological		
First Half of Term	7	14
Second Half of Term	18	30

Particular answers of interest

Boys:

"The development of the ages."

The relationship of all animals in the way they are formed and in their way of life.

"That a true bug is only one order under the heading of Insecta, and that many insects that I thought were bugs are not."

"The structure of different animals and how one animal will have its different body organs in a different position than another animal."

"Where and when fish spawn."

"Ontogeny recapitulates phylogeny."

About the age of trees in California and how their age may be told.

"That roots of plants turn toward the moisture in the soil and the leaves turn toward the heat and light of the sun."

That Mother nature has provided for every one of her children a means of reproduction and living. Also the usefulness of everything to something else, someway or somehow. The ways by which nature accomplishes these things are most interesting such as, pollination, the distribution of seeds for reproduction, etc.

Girls:

The chemical experiments with O_2 and CO_2 and the test for starch.

The many ways the amphibia resemble both aquatic and land animals through gills, lungs, webbed feet, limbs, scales (fossil and extinct forms).

"That the tongue of the snake is used for hearing, rather than taste."

Finding out how really harmless snakes are in comparison to former beliefs.

That so few people in the whole United States die of snakebite.

"I always thought a snake's skin was wet and slimy but by studying Biology I found out that it is dry."

"Everything was interesting except the study of cells."

"The queer (but true) characteristics of Reptiles and certain types of fishes such as the eel."

"That snakes can eat other animals which are much larger in diameter than their own bodies."

The chemistry experiments because "I was amazed at the amount of change one solution could make when another solution was added to it."

"The things we learn about animals and their functions and about ourselves and how we work. Chemistry and that stuff about cells was awful."

"The study of the frog because its organs are so much like man's."

"That Euglena can live both like animal and plant."

"The different ways in which a green leaf is like a factory."

"The orders of insects and all information about them and their relatives."

"That all plants and animals have the three great functions of nutrition, sensitivity, reproduction." (This reply came in several times.)

"The functions and developments of the internal organs of the clam, fish, frog, earthworm." (Not signed.)

"Reptiles—I thought snakes were the only reptiles, and never dreamed that turtles and crocodiles were included in that class."

Most of the statements of part V have been quoted so as not to spoil the original flavor. A few were condensed and changed for the sake of clarity and brevity. A surprisingly large number of replies were given in good grammatical form. Improvement was shown in the use of technical terms, in phrasing and spelling as compared with papers collected in the early work of the course. It is possible and highly desirable to combine practice in writing sentences and paragraphs with the assimilation of scientific facts and ideas.

There are probably too few cases concerned in this study to arrive at more than tentative conclusions. Some correlation between interest and prospective future occupation was shown. A boy interested in agriculture and forestry selected a fact about the California sequoias and ring growth as a factor in determining the age of trees. When the frog was studied it was pointed out that it is often used as a type example reminiscent of the organ-systems of man, an observation which reached a receptive consciousness evidently. Knowledge of the individual and his characteristics as they had been discovered, or seemed to have been, was either confirmed, or in some cases contradicted, in a revealing way. A girl who had seemed to be most prosaic and unimaginative remembered the comparison between the chlorophyll-bearing leaf and a factory and was evidently impressed by the imagery involved in likening the plastids to workers, etc.

The most brilliant-minded person in the two classes chose the animal- and plant-like nature of Euglena as most appealing. A girl who had been thought to be rather conservative in her thinking seemed converted to the pageant of dinosaur life and rock-strata records. Another, planning for missionary work, with pronounced religious views of so-called reactionary type, handed in "prehistoric animals." A girl of non-intellectual and decidedly athletic interests wrote "flowering and non-flowering plants." Two positively did not like the early work on cells, a point not easy to reconcile with the attempt made to bring out their great variety and beauty of form and function. Perhaps the drill accompanying the exercises of the first few weeks had greater influence in causing dislike than attempts to make those particular topics come alive. Or were they so foreign to the experience of the pupils that they were objectionable?

Definite stress was laid upon metamorphosis in frog and insect, upon the transition of animals from water to land with accompanying adaptations and specializations, and the prejudices commonly held against the reptilia. Replies showed that the time spent here was not wasted. Seventeen girls mentioned reptiles in one way or another, as compared to three boys. Just how was the natural repulsion which is felt toward snakes and their kind overcome? It is hard to say. Perhaps the impassioned plea the instructor made and the picture he painted

of a few ignorant neighbors he had seen in town killing some snakes sunning themselves on the rocks near his home had its desired effect.

Fairly early in the course when the relation of chemistry to life was being considered a number of simple demonstrations were performed in class in illustration of points made. It would almost be expected that a number of boys would have had their imagination or interest kindled by these but such seemed not to have been the case. Four girls touch upon chemistry. To one it was very distasteful, to three highly absorbing. Not a single boy in either class mentioned the subject.

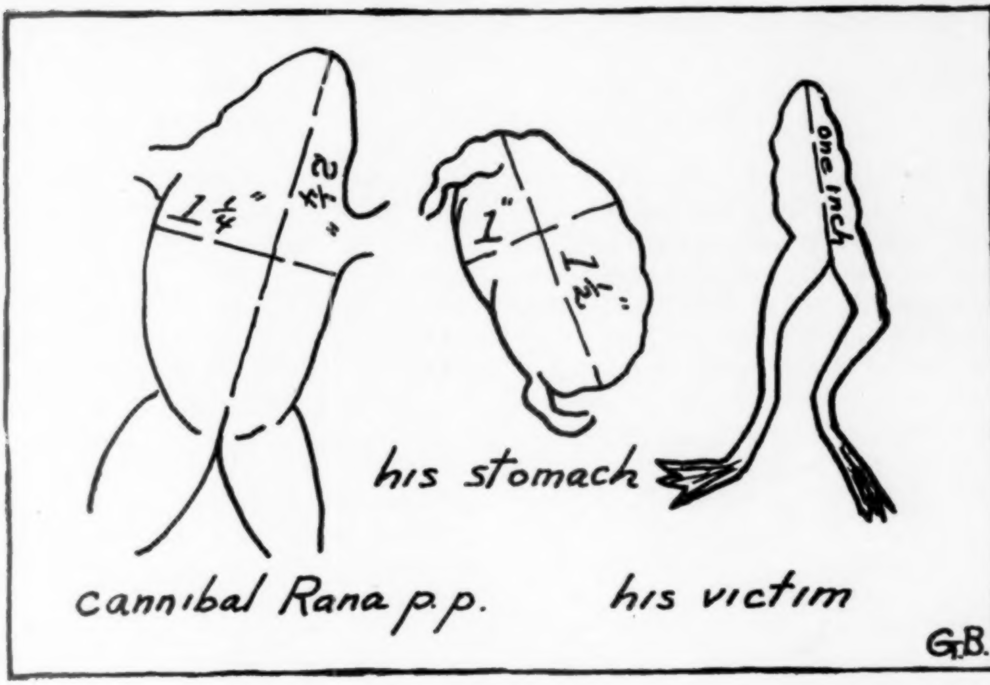
A lad mentioned "marine life" indicating that the picture painted of the rich fauna and flora of the sea had not been in vain, even for one as far inland, to whom it was almost unknown. It may be concluded, perhaps, that the girls were somewhat more specific and detailed than the boys. The better pupils showed greater tendency to write more completely rather than to give a group name such as "invertebrates" or "plants" as their answer. Girls showed great interest in animals but more interest correspondingly than the boys, in plant life. The striking diagnostic characters of the various phyla and large groups were brought out in a progressive and comparative way so that there might be some definite association and means of distinguishing one from the other. If the preponderance of single class or phyla designations is considered the equivalent of these characteristics then morphology is the biological field which possessed greatest interest. The assumption may not be at all warranted, however, because specific anatomical mention is not made in a large number of cases. It is clear, though, that there is a place for the teaching of paleontology in proper manner in present-day secondary school biology. Vertebrates seem more popular with both groups. Great fundamental living processes are generously favored. A very wide range of interest is shown by what might be called a representative, if small, group of youth averaging about fifteen years in a little town not so different from hundreds of others in the eastern states. The wealth of material covered in the first half year of study offered ample opportunity for choice and the pupils availed themselves of it.

"What a Wonderful Bird the Frog Are!"

GRACE BRATLEE
Leeds High School, Leeds, North Dakota

Even to the most squeamish of high school students, there is adventure in each new zoological specimen—the amoeba with its false feet, the starfish with its acrobatic stomach, the shiny cricket with ears upon its elbows, the monsters of detective story fame—the bat and octopus—and all the rest. None, however, arouses their interest as does the common leopard frog, *Rana pipiens pipiens.*

The lowest I.Q. can invariably spout its scientific name without the incentive of an approaching test. Students dissect and draw external views, internal views—spots, webs, spleen, bile duct, fat bodies, ... Every portion of the ranaical anatomy has an enchantment all its own. The tenth "Mine's full of eggs!" causes as much excitement as the first. But the moment of greatest anticipation comes when the stomach is to give up its



secrets. In fact, the years have taught me to save the dissection of this organ until last as a sort of grand finale to the study of this Anura. A depleted savings bank could not bring forth a more disappointed "Mine's empty!" than does an empty frog!

The already mentioned years have been kind and left me still capable of sharing the excitement of students who find two bumble bees, a cricket, the wing covers of a beetle, a grasshopper, or, perhaps even a lady bird or a woolly bear in frog stomachs and of sharing the disappointments of those whose work reveals that "this little frog had none."

This year was not much different from the many others in most respects—just in one! One stomach was opened with reluctance. The whole frog had been more or less a disappointment. First, it was much smaller than the other frogs; secondly, the removal of the ventral wall exposed a distorted liver and intestines; the whole abdominal cavity seemed filled with a misshaped pouch. "Squashed in pickling" was the verdict of the young lady scientist. Opened, and incidentally the last in class to be opened, the stomach produced a veritable "find"—another *Rana pipiens pipiens!* Everyone rushed to admire the wonder. I did too. For of the 500 or more *Rana pipiens pipiens* that I had caught in the ponds, lakes, and streams of Minnesota and North Dakota or had secured from biological supply houses, this was the first of these amphibians to reveal a case of cannibalism!

The title will be recognized as the first line of the following bit of nonsense verse, variously attributed to many authors, and encountered in various versions:

What a wonderful bird the frog are!
When he hop he fly almost,
When he stand he sit almost,
Aint got no sense hardly,
Aint got no tail hardly either
So when he stand
He sit on what he aint got almost!

The Saga of Bessie, The Body Cell*

JUDY BOLNICK
Von Steuben High School, Chicago, Illinois

This is the story of Bessie, a body cell who lived in A Higher Organism. Bessie was a good little cell; she minded her own business and attended to her osmosis and oxidation as all good cells should. Then one day Bessie noticed that she was different from the other little cells around her. She was growing bigger and bigger. Something was bound to happen. And suddenly, it did.

"Well bless my chromatin!" said Bessie. "My centrosomes are not over my nucleus any more, the way they belong. Where——————?"

Suddenly, she spied them moving off to one side. Before she had a chance to do anything about it, she noticed that something was happening in her nucleus. Her chromatin had slid over and was arranging itself on her linin fiber. Bessie looked desperately around for help.

"It's all right, dear," said one of the elderly cells. "That's just your spireme. It always happens when a cell is d——."

But Bessie wasn't listening any more. Too many new things were happening. Her chromatin linin had split into chromosomes and her nuclear membrane was disintegrating!

"Heavens! I'm falling apart!" cried Bessie. She was so worried that she didn't even notice what was happening to her centrosomes (and it's a good thing, because she would have been really frightened then!) There were fibers growing out from them towards the center. Suddenly they were there, and one fiber from each end attached itself firmly to each chromosome. The chromosomes arranged themselves in a row across Bessie's middle.

"Just like the equator!" Bessie told her friends after it was all over.

But they didn't stay put. The chromosomes simply divided in half and began to move away from each other toward the centrosomes. Soon they reached their destination. Bessie's fibers were beginning to disappear, and wonder of wonders! Her nuclear membrane began to reappear. But the odd part of it was, there were two of them, and they were both alike.

Suddenly Bessie felt a pain in her middle. She looked down, and to her horror, she was pinching together. Her waist grew smaller and smaller. She was just beginning to feel proud of her beautiful figure, when POP! There were two of her. Bessie had pinched in two. All at once Bessie knew what had happened. She had *Reproduced!*

* Note from Judy's instructor, Miss Esther C. Rasmusen: "Following a discussion of mitosis in a 2B Biology class, I assigned the class the task of writing the story of mitosis in their own words. . . . Judy Bolnick submitted the most original story."

BY THE WAY

FOR MAXIMUM VARIETY, protozoan infusions should be started at three- or four-day intervals, since the populations of protozoa reach a high degree of stability after the fourth or fifth day. If a single species is wanted in high concentration the time depends on the species desired. For example, *Vorticella* is apt to appear in greatest numbers about the third day, while *Paramecium*, especially *caudatum*, does not reach its peak until the fifth to seventh day.

THE SIDES OF CORRUGATED PAPER packing boxes, cut to $11\frac{1}{2} \times 16$ inch size, make entirely acceptable separators for packing plants into a plant press. If possible they should be cut so that the corrugations run the short way of the press; this provides for better air circulation.

Doing in Conservation

OSCAR M. ROOT
Brooks School, North Andover, Massachusetts

Arthur H. Bryan, in his article *Conservation* in the Conservation Issue of *The American Biology Teacher* for January, 1943, connotes doing as well as merely learning in the field of conservation when he states that "Local problems should be given special treatment" and that "It isn't always the sportsman who ruins game, but, it is sometimes private industries." His last statement is "The government is doing its part; it's up to us to do ours." Our part, I believe, is to teach pupils how and what to do to help in the conservation battle as well as to teach them *about* the fight.

Much of the greatest progress achieved in conservation has been the result of brilliant victories gained after bitter struggles against determined and sometimes unscrupulous opposition. We owe a great deal to such militant and high-principled conservationists as Dutcher, Hornaday, Theodore Roosevelt, and Mrs. Edge. In certain fields we cannot go forward unless we are willing to fight with determination for what we believe to be right. The long-range program of education and local sanctuaries of some conservation organizations will not suffice in problems of national import requiring immediate and forceful action. Such a problem is the pollution of our waters by sewage and industrial wastes.

This problem has been before the American people for many years. The solution has been left to the states and municipalities, but replies to a questionnaire sent in 1945 by the Izaak Walton League of America to the appropriate officials of the 48 states and the District of Columbia revealed appalling conditions and showed conclusively that local laws are completely inadequate in a great majority of the states. Two desirable companion anti-pollution bills, H.R. 519 (Mundt) and S. 535 (Myers) now in Congress* empower the Federal government to prevent new pollution and to eliminate in time all pollution from the waters of the United States. Provision against encroachment upon states' rights is made, and pollutors are given fair treatment through the provision of ample time for complying with the law. They are also made eligible for federal grants or loans for the construction of treatment plants.

Another pollution bill, H.R. 587 by Smith is less desirable though acceptable, while still another, H.R. 4070 by Spence is wholly unsatisfactory to conservationists for several reasons. It entirely lacks "teeth" for enforcement, does not make pollution from *new* sources unlawful after passage of the act, nor does it make *all* pollution unlawful in a reasonable time after passage of the act. Moreover, it does not protect the interests of sportsmen and conservationists by providing for membership of the United States Fish and Wildlife, Forest, and Soil Conservation Services on the *operating* board of the antipollution agency. This representation is provided for by the Mundt bill.

Public hearings on the Mundt, Smith, and Spence bills took place before the House Rivers and Harbors Committee on November 13, 14, and 15, 1945.

I felt that here lay an opportunity to

* NOTE: These bills were in Congress at the time the article was written; actually of course they are not now, since Congress adjourned without acting on them.

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JUDY BOLNICK
Von Steuben High School, Chicago, Illinois

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Suddenly, she spied them moving off to one side. Before she had a chance to do anything about it, she noticed that something was happening in her nucleus. Her chromatin had slid over and was arranging itself on her linin fiber. Bessie looked desperately around for help.

"It's all right, dear," said one of the elderly cells. "That's just your spireme. It always happens when a cell is d——."

But Bessie wasn't listening any more. Too many new things were happening. Her chromatin linin had split into chromosomes and her nuclear membrane was disintegrating!

"Heavens! I'm falling apart!" cried Bessie. She was so worried that she didn't even notice what was happening to her centrosomes (and it's a good thing, because she would have been really frightened then!) There were fibers growing out from them towards the center. Suddenly they were there, and one fiber from each end attached itself firmly to each chromosome. The chromosomes arranged themselves in a row across Bessie's middle.

"Just like the equator!" Bessie told her friends after it was all over.

But they didn't stay put. The chromosomes simply divided in half and began to move away from each other toward the centrosomes. Soon they reached their destination. Bessie's fibers were beginning to disappear, and wonder of wonders! Her nuclear membrane began to reappear. But the odd part of it was, there were two of them, and they were both alike.

Suddenly Bessie felt a pain in her middle. She looked down, and to her horror, she was pinching together. Her waist grew smaller and smaller. She was just beginning to feel proud of her beautiful figure, when POP! There were two of her. Bessie had pinched in two. All at once Bessie knew what had happened. She had *Reproduced!*

* Note from Judy's instructor, Miss Esther C. Rasmusen: "Following a discussion of mitosis in a 2B Biology class, I assigned the class the task of writing the story of mitosis in their own words. . . . Judy Bolnick submitted the most original story."

BY THE WAY

FOR MAXIMUM VARIETY, protozoan infusions should be started at three- or four-day intervals, since the populations of protozoa reach a high degree of stability after the fourth or fifth day. If a single species is wanted in high concentration the time depends on the species desired. For example, *Vorticella* is apt to appear in greatest numbers about the third day, while *Paramecium*, especially *caudatum*, does not reach its peak until the fifth to seventh day.

THE SIDES OF CORRUGATED PAPER packing boxes, cut to $11\frac{1}{2} \times 16$ inch size, make entirely acceptable separators for packing plants into a plant press. If possible they should be cut so that the corrugations run the short way of the press; this provides for better air circulation.

Doing in Conservation

OSCAR M. ROOT
Brooks School, North Andover, Massachusetts

Arthur H. Bryan, in his article ***Conservation*** in the Conservation Issue of *The American* ***Biology Teacher*** for January, 1943, connotes doing as well as merely learning in the field of conservation when he states that "Local problems should be given special treatment" and that "It isn't always the sportsman who ruins game, but, it is sometimes private industries." His last statement is "The government is doing its part; it's up to us to do ours." Our part, I believe, is to teach pupils how and what to do to help in the conservation battle as well as to teach them *about* the fight.

Much of the greatest progress achieved in conservation has been the result of brilliant victories gained after bitter struggles against determined and sometimes unscrupulous opposition. We owe a great deal to such militant and high-principled conservationists as Dutcher, Hornaday, Theodore Roosevelt, and Mrs. Edge. In certain fields we cannot go forward unless we are willing to fight with determination for what we believe to be right. The long-range program of education and local sanctuaries of some conservation organizations will not suffice in problems of national import requiring immediate and forceful action. Such a problem is the pollution of our waters by sewage and industrial wastes.

This problem has been before the American people for many years. The solution has been left to the states and municipalities, but replies to a questionnaire sent in 1945 by the Izaak Walton League of America to the appropriate officials of the 48 states and the District of Columbia revealed appalling conditions and showed conclusively that local laws are completely inadequate in a great majority of the states. Two desirable companion anti-pollution bills, H.R. 519 (Mundt) and S. 535 (Myers) now in Congress* empower the Federal government to prevent new pollution and to eliminate in time all pollution from the waters of the United States. Provision against encroachment upon states' rights is made, and pollutors are given fair treatment through the provision of ample time for complying with the law. They are also made eligible for federal grants or loans for the construction of treatment plants.

Another pollution bill, H.R. 587 by Smith is less desirable though acceptable, while still another, H.R. 4070 by Spence is wholly unsatisfactory to conservationists for several reasons. It entirely lacks "teeth" for enforcement, does not make pollution from *new* sources unlawful after passage of the act, nor does it make *all* pollution unlawful in a reasonable time after passage of the act. Moreover, it does not protect the interests of sportsmen and conservationists by providing for membership of the United States Fish and Wildlife, Forest, and Soil Conservation Services on the *operating* board of the antipollution agency. This representation is provided for by the Mundt bill.

Public hearings on the Mundt, Smith, and Spence bills took place before the House Rivers and Harbors Committee on November 13, 14, and 15, 1945.

I felt that here lay an opportunity to

* NOTE: These bills were in Congress at the time the article was written; actually of course they are not now, since Congress adjourned without acting on them.

teach my pupils how to do something to aid in the struggle for conservation. We wrote and signed jointly letters to our Senators, Congressmen, and to Representative Joseph J. Mansfield of Texas, Chairman of the House Committee, urging their support of the bill. Interesting letters were received from all the men to whom we wrote. Great interest and enthusiasm were shown by the students. One boy was eager to sign the letter in spite of his father's opposition to the bill. Another boy preferred not to sign the letter. Another wrote, during his holidays, a letter to his Senator. Another wrote an excellent essay on the subject in his English class. The question was proposed by a student as a topic for debate in the School Forum, and a lengthy account of our activity appeared in the school newspaper. One student did some original research during the holidays, interviewing some industrialists and engineers in order to get their point of view. He then wrote an essay on the problem which was submitted to the school magazine.

In addition, we unsuccessfully sought action by the local Women's League of Voters. A fine account of our activities was printed in the local newspaper. We urged aggressive action on the part of Audubon Societies of two different states by means of an interview and correspondence with their officers. Members of the local Fish and Game Club enthusiastically accepted our suggestion that they get into this fight.

The House committee did not report on any of the pollution bills, but instead, a new anti-pollution bill, embodying features of both the Mundt and Spence bills, was introduced in the House by Congressman Mansfield. It was referred to his own committee and subsequently was reported favorably to the Calendar. The new bill met the serious objections to the Spence bill and was endorsed by the Izaak Walton League and other conservation organizations because of its inclusion of the enforcement provision of the Mundt bill. Unfortunately, the Seventy-ninth Congress adjourned in July without taking a vote on the Mansfield bill. This must be introduced as a new bill in our next Congress, and those interested in its passage must again fight for a hearing and vote.

I believe that biology teachers will find this type of project an interesting and valuable one. The lesson to students in citizenship is obvious, and the possible aid toward victory in such a fight should not be underestimated. Should the possibility of defeat, a real one, be realized, the students will learn something of the difficulties and price of human progress toward ideals. Teachers may learn how to help in the pollution battle by writing to *The Izaak Walton League of America*, 31 North State Street, Chicago 2, Illinois. Up-to-date information on all federal conservation legislation may be secured at no cost through "Conservation News" published by the *National Wildlife Federation*, 1212 Sixteenth Street, N.W., Washington 6, D. C. Information on how to fight for conservation can be obtained from the *Emergency Conservation Committee*, 767 Lexington Avenue, New York 21, N. Y.

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Continued on Page 63.

Important Aspects of Biology in National and International Economy*

H. P. K. AGERSBORG
McKendree College, Lebanon, Illinois

Biology is the only science that offers a perfect demonstration on how man may organize and manage his society in its many complex ramifications. The principles of development, organization and function of the body of higher animals are in many respects common to all multicellular groups from the lower to the higher including man. The entire organic creation, with its countless number of species, represents protoplasmic expressions in response to internal and environmental stimuli. Nowhere is the fad of "free enterprise" manifest save among the invisible protista; unrecognized entities everywhere, save as parasites, or as cells gone a-muck, as in diseases such as malaria, pneumonia, cancer and the like. Here free enterprise reaches its climax in nature, and is not worthy of application in human society. The healthy body of any species demonstrates: *how to carry on.* It is the example of the principle of cooperation at work. No organism, no matter how wonderfully made, can grasp the significance of this principle of organic cooperation, save man. But man has not assimilated this wonderful principle yet; some know about it; but no one talks about it. Because of lack of understanding this god-prepared directive, man still lives with and on one another very much like animals. If and when man truly discovers and puts into practice the organismal principle of cooperation he will live with and for one another, rather than with and on one another. Because of his marvelously potential nervous system, only man can set up a social economy in which to live as successfully with and for one another as do the billions of countless differently made cells in the body of a healthy person.

This is the road to a happy, healthy, progressive, and tranquil social economy for the state, the nation, mankind. But it will not, it cannot be attained unless everyone humbles himself and goes to nature and considers her way; for there the principles on how man may live with one another are laid down.

The free enterprise business, biologically speaking, is exceedingly primitive and should have been long since tabooed; manifestations of its principle are demonstrated by disturbances of all sorts. On the other hand, the cooperative business of life points the way man must choose if he is ever to reach the Creator's goal for him: a new earth in which righteousness dwells.

In a practical sense, this means that the study of biology must be made as universal as the study of how to speak and write. Before this is done, the laws of cooperative enterprise, written in the body of the multicellular organisms by the Creator Himself for man to follow, will be ignored or misunderstood.

Surely here is a most wonderful challenge for anyone. Who can deny it is hard to apply it as the remedy for man's social and economic ills? But is it too hard for modern man? Does he not like to tackle difficult problems? He, who by mastering many physical laws has as some claim made himself master of his own destiny, must choose between life and death; if he is his own master, he is, nevertheless, in bondage to his own species, man himself, and will destroy himself, as no other species has ever done, unless he learns to get along with man himself. The ideal thing is the most practical. Its values are determined by the consequences. If nature's most successful creation is the multicellular organism; topmost among them is man. Since this is wonderfully true, the formula for socio-economic wellbeing among man is the organismal cooperative enterprise-principle where no part is boss at the expense

* Read before the AMERICAN SOCIETY OF ZOOLOGISTS, March 29, 1946, at St. Louis, Missouri.

of any other part; where joy is perfect when the entire body is whole. However, it will hardly be possible to realize this, or even practical to propose or promote such an order of things to any people so untutored in biological laws as our nation is. The co-operative enterprise principle manifest in the body of the healthy person will be easily understood by most people when biological principles are studied universally. The first job, then, in order to obtain national and international understanding is to teach principles of biology to all men and to apply them in town, village, state and nation, among all mankind. This is the way. It is the Creator's law on how to get along with one another; we must follow it, or die.

Editor's note: Any reader of THE AMERICAN BIOLOGY TEACHER may submit articles or editorials; all contributions are carefully considered, and if in the judgment of the editorial staff they are important, they are accepted, regardless of whether they happen to agree with the opinions of the staff. It must always be understood that signed articles represent the opinions of their authors, and not necessarily those of the publishing journal. For example, in the case of this article, no reader should assume that THE AMERICAN BIOLOGY TEACHER considers the "fad" of free enterprise "not worthy of application in human societty." In fact, the editor (who does not speak for the individual opinions of his staff members) believes that in a society made up of individuals who have intelligence the whole concept of co-operation has meaning only within the framework of free enterprise. There will no doubt be much disagreement concerning some of the statements in this article; there can be little concerning the importance of the subject—therefore the article is published.

All biology teachers have seen many articles *by* E. Laurence Palmer, but the current September–October issue of *Audubon* magazine contains a full-length illustrated article *about* E. Laurence Palmer, dealing with his interests, achievements, hobbies, and influences on nature study and nature study teaching. If there are any readers of *The American Biology Teacher* who are not familiar with the *Audubon* magazine, they should take this opportunity to make its acquaintance.

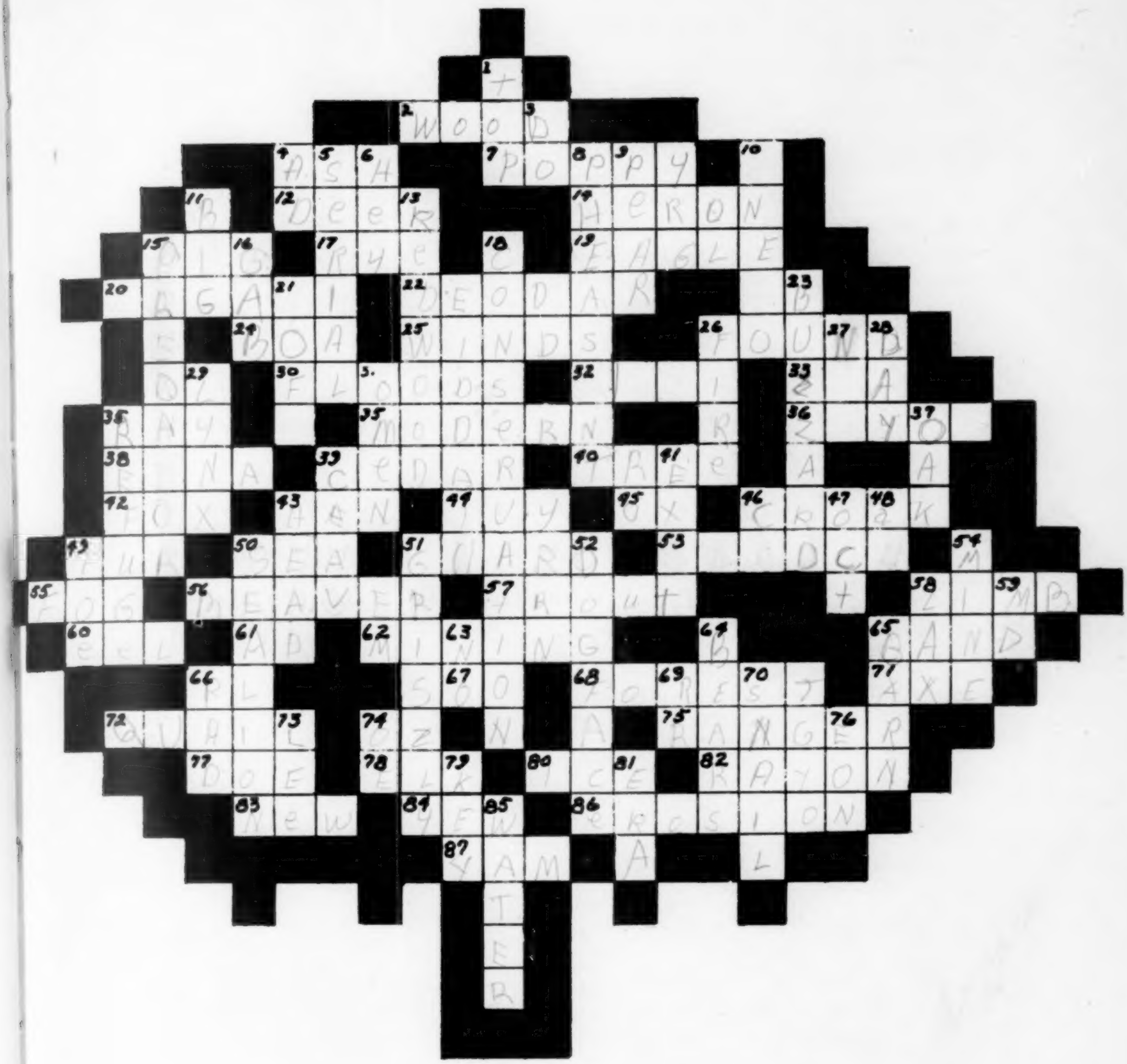
A Conservation Puzzle

HORIZONTAL

2. The chief product of the forest
4. A broadleaf tree of the olive family
7. A plant from which we secure opium
12. A large animal with antlers found in our forests
14. A long-legged wading bird
15. A young swine
17. A cultivated cereal grass
19. The official bird of the U. S.
20. Another name for wild Mountain Sheep
22. A famous cedar from India
24. A tropical snake which crushes its prey
25. Air in motion (plural)
26. Not lost
30. These result when forests are destroyed and rain falls
32. Against
33. A meadow
34. A beam of light
35. New-fashioned
36. A Christmas Berry
38. A mountain in Italy
39. A conifer having fragrant foliage
40. Our lumber comes from this
42. A crafty member of the dog family
43. A female bird
44. A poisonous vine
45. A domesticated cow-like animal
46. A sound made by frogs
49. A pelt
50. A body of salt water
51. A National Forest Officer
53. This group includes the Pine Beetle
55. A cloud which touches the ground
56. A large fur-bearing rodent
57. A game fish found in our mountain streams
58. Part of a tree
60. A snake-like fish
61. A preposition
62. This process removes one of our natural resources
65. A group (as of sheep)
67. A place where animals are shown
68. A dense growth of trees
71. We use this tool to cut down trees
72. A common upland game bird
74. Abbreviation for ounce
75. The man who looks after our forests
77. A female deer
78. A large member of the Deer Family
80. Water in the solid state
82. A textile made from trees
83. Recent
84. An evergreen needle leaf tree having red berries
86. Forests prevent —?— of the soil by wind and water.
87. A sweet potato

VERTICAL

1. The upper part of a tree
3. To produce
4. An advertisement
5. Arranged in a series
6. An exclamation of surprise
8. An oriental bird that has been successfully introduced in the United States
9. A popular cultivated orchard tree
10. This means wind
11. Not small
13. The tallest trees found in California
15. An animal that preys on others



A Conservation Puzzle

16. Chatter
18. Saving our natural resources by using them wisely
21. A roosting place for birds
23. A large black bird which feeds on carrion
26. This is a major enemy of our forests
27. Meaning new or recent
28. The period of the earth's rotation on its axis
29. A member of the Cat Family
31. A sign of a future event
34. A sanctuary for wildlife
37. A broadleaf tree bearing acorns
41. A way of departure
43. A basic necessity of life
47. Abbreviation for a month of the year
48. A preposition
49. An enemy
50. A large ocean mammal
51. A large powerful bear
52. The official Calif. State Butterfly, which also has iridescent wings
54. An excavation to get ores
58. Not rigid or strict
59. Abbreviation for the degree of Doctor of Medicine
63. Negative
64. A wild animal that hibernates
65. A building for storing hay
66. Found on a cat's foot
69. This means Railroad
70. A mollusk having a coiled shell
73. The side away from the wind
76. A division of geological time
79. We consult this when we wish to identify a plant or animal
81. A long period of time
85. Our forests help to store this for summer use

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Reviews

COOK, ROBERT C. and BURKS, BARBARA S., *How Heredity Builds Our Lives.* American Genetic Association, Washington 5, D. C., 64 pp. 1946. 75c.

This well illustrated little book was first published as a special issue of *Eugenical News.* The authors refer to it as an introduction to Human Genetics and Eugenics; this is perhaps a somewhat ambitious characterization for a 64 page booklet. The chapter titles are *Living Building Blocks, Unravelling Heredity and Environment, What Environment Can Do* and *Looking at Life Eugenically.* Most of the photographs have appeared in the Journal of Heredity and will be familiar to long time readers of this journal. Many of the charts and drawings are by Clyde E. Keeler, who has contributed several articles to The American Biology Teacher. Much of the book is written in the style of the Journal of Heredity, but of course less technical, since this is a general treatment. There is a brief but well organized index. The book should prove highly valuable as a reference in elementary genetics and the study of heredity in general biology courses.

JOHN BREUKELMAN

CAMOUFLAGE IN NATURE, *Coronet Instructional Films,* Coronet Magazine, Chicago, Illinois.

Two notable films for use in nature study and biology, in both elementary and secondary schools are *Camouflage in Nature,* through *Form and Color Matching,* and through *Pattern Matching.* The first film, after some introductory shots, illustrates protective resemblance, mimicry, counter shading and color matching; for each division there is a variety of shots, some of them of the familiar forms such as the viceroy and monarch butterflies, others of less well known examples, such as the robber fly and flower fly. The exceptions are taken into account and it is mentioned that if protective resemblance always worked, the carnivorous animals would not be able to feed. The second film uses shots of a large variety of animals and plants, and emphasizes its point by the use of demonstration models to show the effects of horizontal and vertical lines, polka dots, and the like, also by comparing a museum mount with a live specimen in its native environs. There are shots to illustrate the confusing effects of bold patterns such as that of the Polyphemus moth and of prominent appendages such as are found in the pheasant; the importance of six differences is explained. In both films the narrative is concise but not dogmatic, mentioning differences of interpretation from time to time. Coronet Magazine is to be congratulated for reaching such a high standard in its early productions, and to be admonished not to allow their standards to slip, for good instructional films are still far from abundant.

HÖBER, RUDOLF, with the collaboration of David I. Hitchcock, J. B. Bateman, David R. Goddard, and Wallace O. Fenn. *Physical Chemistry of Cells and Tissues.* 1st ed. The Blakiston Company, Philadelphia. xvii + 676 pp. 70 illus. 1945. $9.00.

This is a book of original research recording the results of extensive studies in various fields of physical chemistry in their application to general and medical physiology. The theme is physiology as a branch of physiochemical science dealing with life as a physical system. New facts and unsolved problems are discovered as cell life is studied with the tools of modern physics.

The book is written in eight sections: *Selected Principles of Physical Chemistry; Large Molecules; Architecture of Protoplasm; Surface of the Protoplast; Influence of some Extracellular Factors on Cellular Activity; Respiration of Cells and Tissues; Contractility; Passive Penetration* and *Active Transfer in Animal and Plant Tissues.*

Written at the level of the college or medical school student, the book contains appropriate charts, tables and illustrations; an index of authors and subjects; a bibliography. At the end of each chapter is a list of the principal notations used in Section I and a list of textbooks of physical chemistry which aid in understanding this book. All these are helpful. Although the book is beyond high school pupils, high school teachers will find it useful as a background and as a reference.

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Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three or four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. The manuscripts for this issue were submitted last spring and summer. On the average, a manuscript submitted this month may expect to find its way into print, if it is accepted promptly, in about March or April. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustrations, etc., consult *Preparation of Manuscripts for Publication*, which appeared in the October, 1943, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is still available; copies may be obtained from the editor.

Manuscripts may be sent to the editor-in-chief or to any one of the associate editors. A complete list of the latter appears in each October and February issue.

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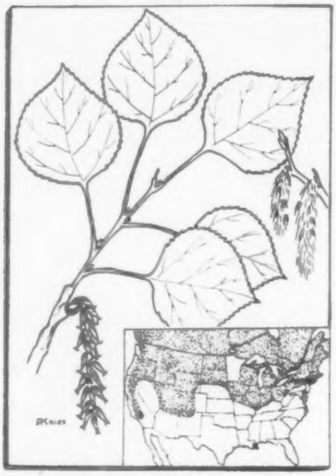

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